Quantifying the weather risk to European power markets this winter

The increasing level of renewable capacity and the gradual electrification of heating demand in Europe mean that the impact of weather conditions on electricity prices this winter will be greater than ever before.

In the event of a mild winter, some European power markets could see a drop in residual demand of up to 17%, compared to a scenario of average weather conditions, leading to a price drop of around €15/MWh.

Conversely, if the weather turns cold for the rest of winter, an almost equivalent upside could be expected, with prices in Q1 2024 for all European power markets outturning far above the day-ahead deliveries from Q1 this year.

ICIS Power Foresight modelling of weather conditions across European markets show that the difference between a cold and mild winter would account for around a 14bcm swing in gas consumption from the power sector (6% of total European gas demand). This is because gas plants account for 60% of the change in residual demand that stems from weather.

Likewise, European carbon emissions from the power sector could see a 20% swing between a cold and mild scenario for the rest of winter, which equates to around 10% of total ETS-scope emissions.

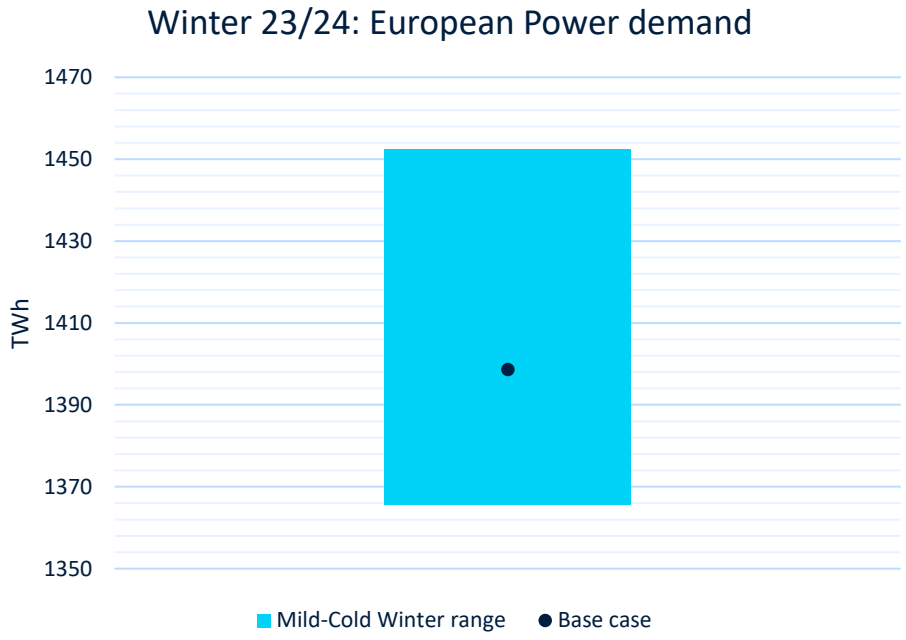
Methodology

- The aim of this analysis is to evaluate the impact of this winter's weather conditions on European power markets. To this end, we defined a cold winter scenario and a mild winter scenario, to be compared with the ICIS base case.
- Based on the examination of historical weather data since the year 1982 (on an hourly basis, for 43 European power market zones), we identified the historical weather year **2010**, as the representative **cold winter weather year** and the historical weather year **1994**, as the representative **mild winter weather year**.
    - The ICIS base case is based on the historical weather year 2016.
- In the following we focus on the period from 1 November 2023 to 31 March 2024, herein referred to as 'winter 23/24'.
- The simulations are performed with the ICIS Power Foresight model, which is a pan-European fundamentals-based power market model, and the results are shown on the portal with daily updates.

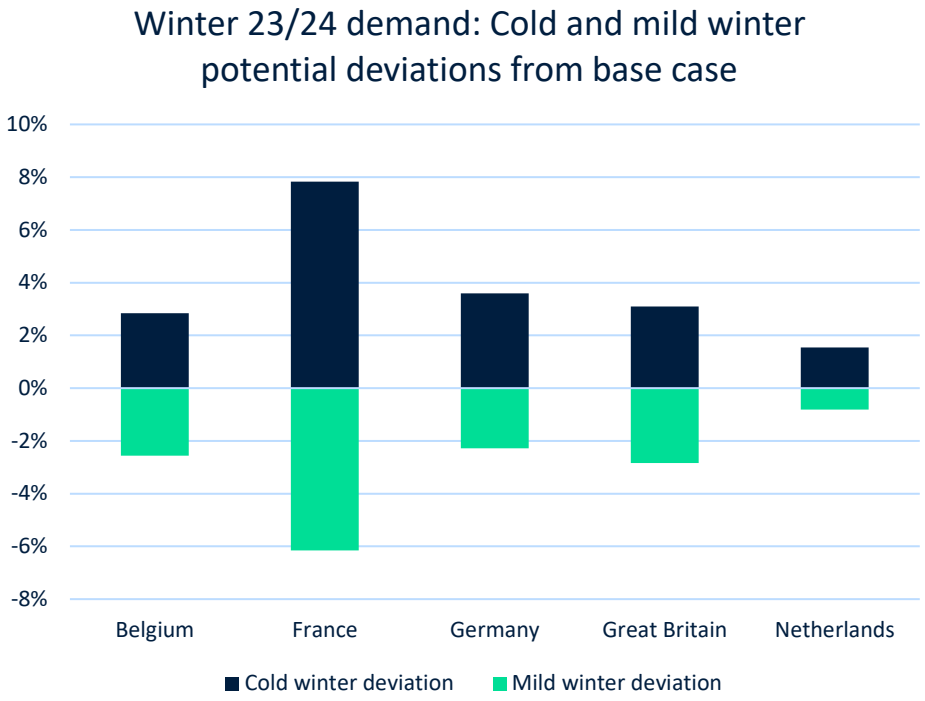
- The intention of the analysis is to assess the direct impact of weather on demand and renewable generation in Europe. All other variables, including fuel prices, are unchanged between the scenarios and are based on the information available as of 27 October 2023.

Demand

- The analysis of the historical weather data showed that 2010 and 1994 hourly profiles yield, respectively, the highest and the lowest demand at the European level during the winter period.
- Compared to our base case winter demand of around 1,400TWh at European level (EU27 + GB + CH+ NO), the cold winter scenario entails a 3.8% increase and the mild winter scenario a 2.4% decrease, thus totalling a 6.2% temperature-driven demand swing (i.e., 87TWh).

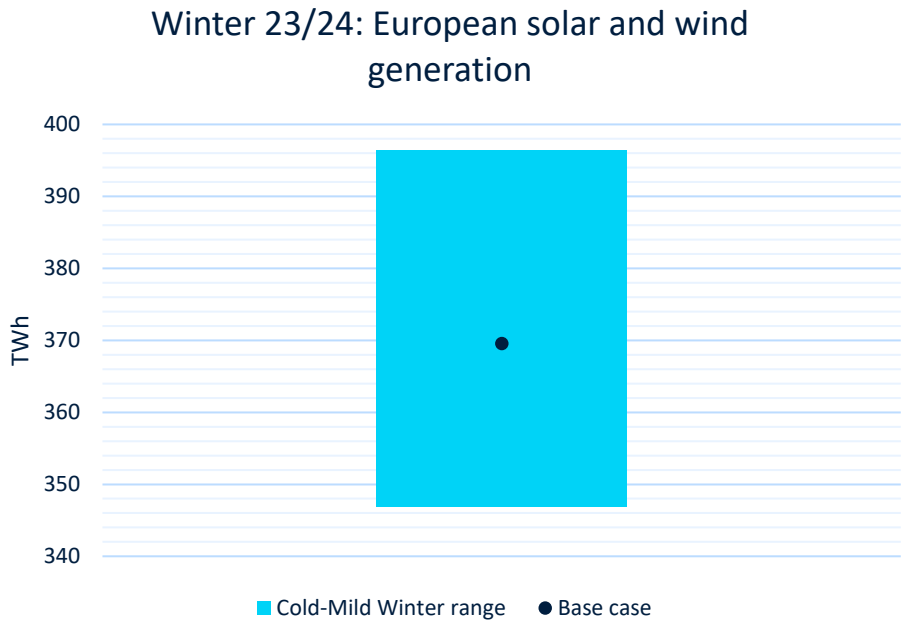


- At country level, we focus on five Central Western European market zones: Belgium, France, Germany, Great Britain, and the Netherlands.
    - In terms of temperature-driven demand swings, the higher the share of electric heating, the higher the potential variation.

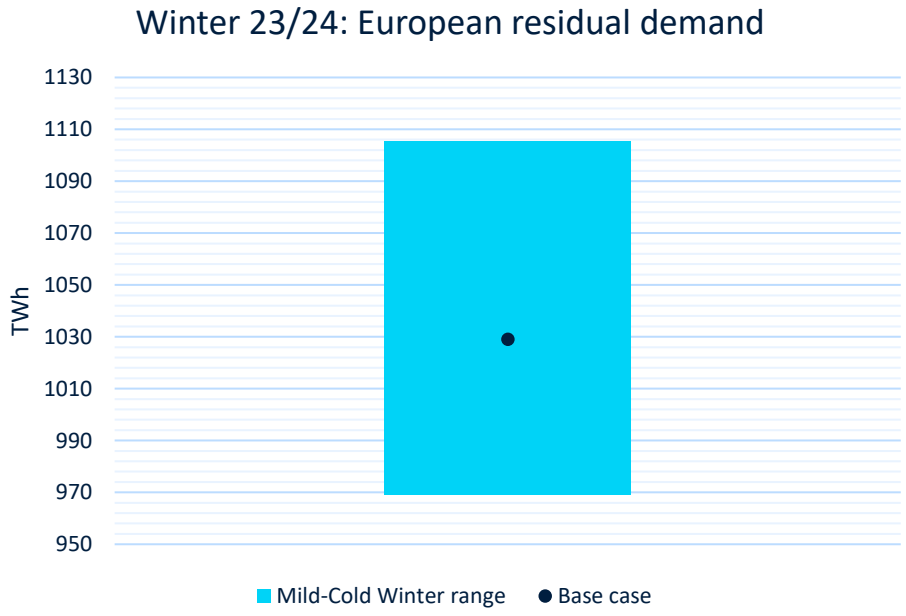


Solar and wind generation

- To preserve climate data consistency, we considered solar radiation and wind speed hourly profiles from the same historical weather years as the demand profiles. Indeed, as discussed here, a significant correlation exists between cold/mild winters (i.e., higher/lower demand) and still/windy winters (i.e., poor/strong generation).
- As a result, the cold winter scenario entails a 6.1% drop in European solar and wind generation compared with the base case, while the mild winter scenario is characterised by a 7.3% increase.
    - The total swing in solar and wind generation is thus 13.4%, namely around 50TWh.

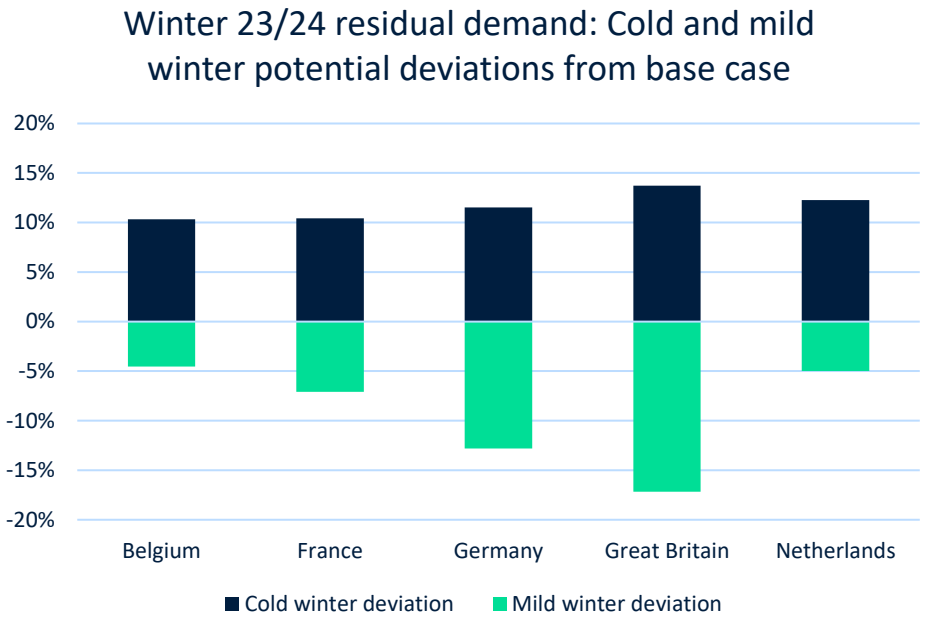


- The overall swing in residual demand (the difference between the total demand and the wind and solar generation) is thus around 135TWh, which is 13.2% of the base case residual demand.



- At country level, the larger the wind capacity (especially offshore), the bigger the impact weather conditions can have in terms of renewable generation.

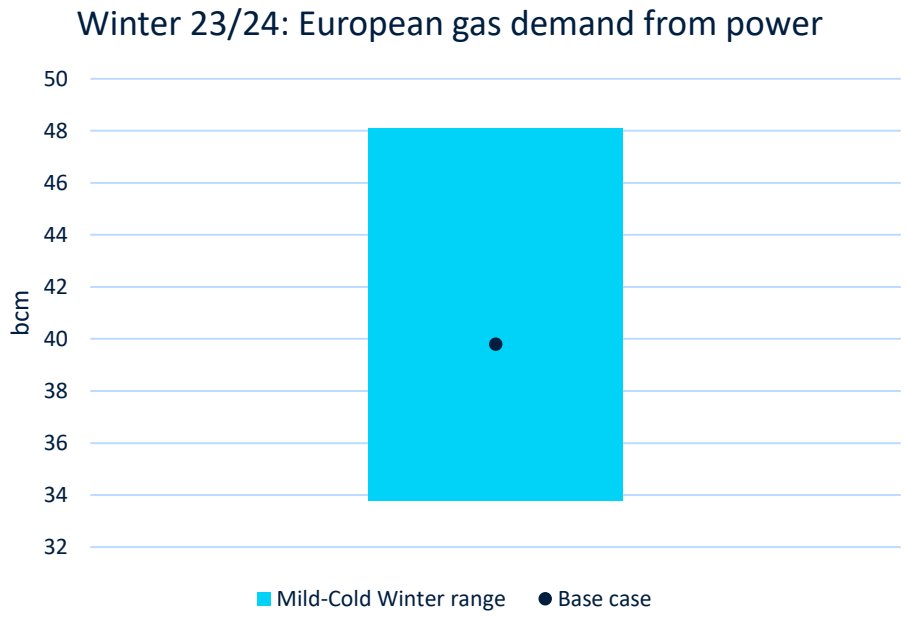
For this reason, Great Britain and Germany show the greatest variability in terms of residual demand.



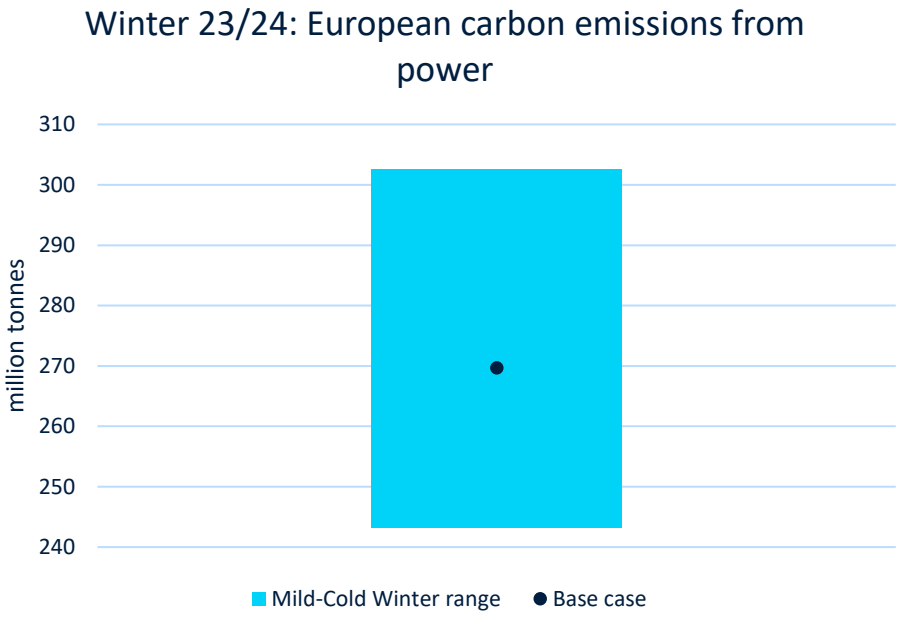
Results

Gas generation and carbon emissions

- At the European level (EU27+GB+NO+CH), gas-fired generation is expected to range from 187TWh in the mild winter scenario up to 268TWh in the cold winter scenario.
- This results in a swing of about 14bcm in terms of gas consumption from the power sector, thus impacting around 6% of the overall European gas balance in the winter period.
- Interestingly, gas generation would meet around 60% of the additional residual demand in the cold winter scenario and, likewise, would contract by 60% of the reduction in residual demand in the mild weather scenario.
    - In other words, given the current fuel prices, gas generation will cover about 60% of the change in net demand, while the remaining 40% will be covered by a mix of other flexible technologies (e.g., coal, oil, etc.).

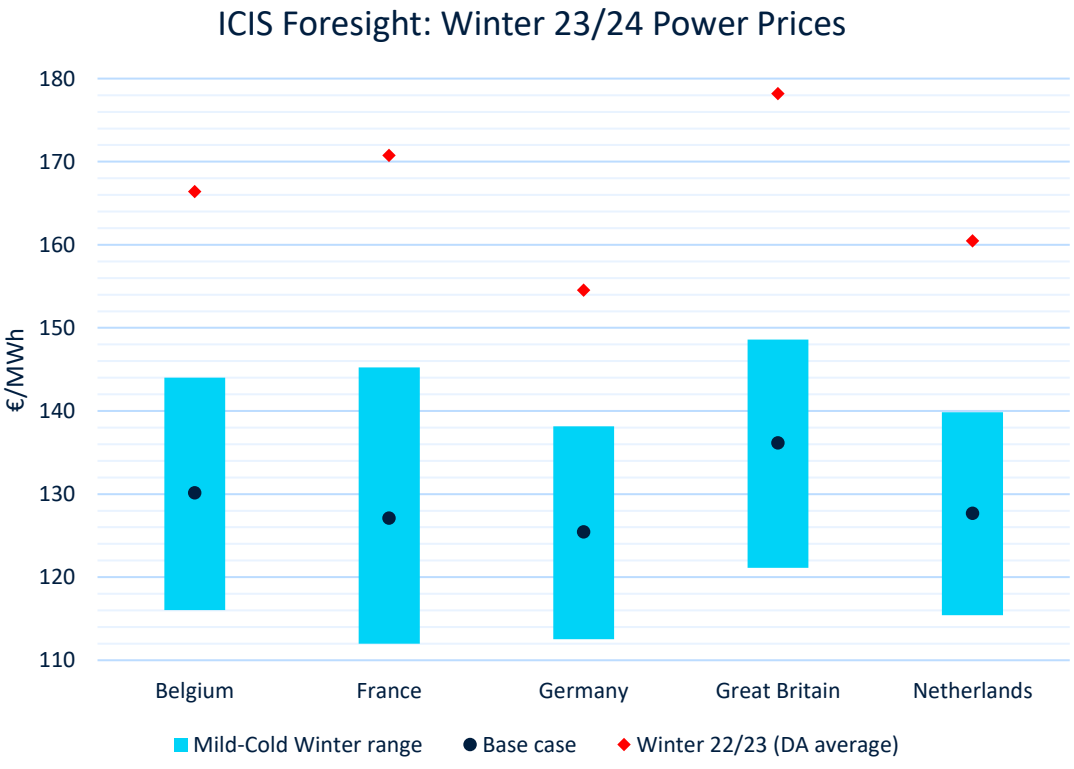


- European carbon emissions from the power sector, which account for around half of the ETS-scope emissions, could be affected up to a 20% swing by weather conditions next winter.
- The upward and downward variations compared with the base case are symmetrical, namely around 10% in both the mild and cold winter scenarios, meaning that the upside and downside risks are balanced.
- The variation in carbon emissions is about 0.44 million tonnes of CO2 per TWh of variation in residual demand. Namely, this is the carbon emission factor of the mix of technologies (60% gas, 40% other) covering the swings in the winter net demand.
- An in-depth analysis on carbon emissions and fuel switching in relation to the Winter 23/24 scenarios will soon be published.



Power prices

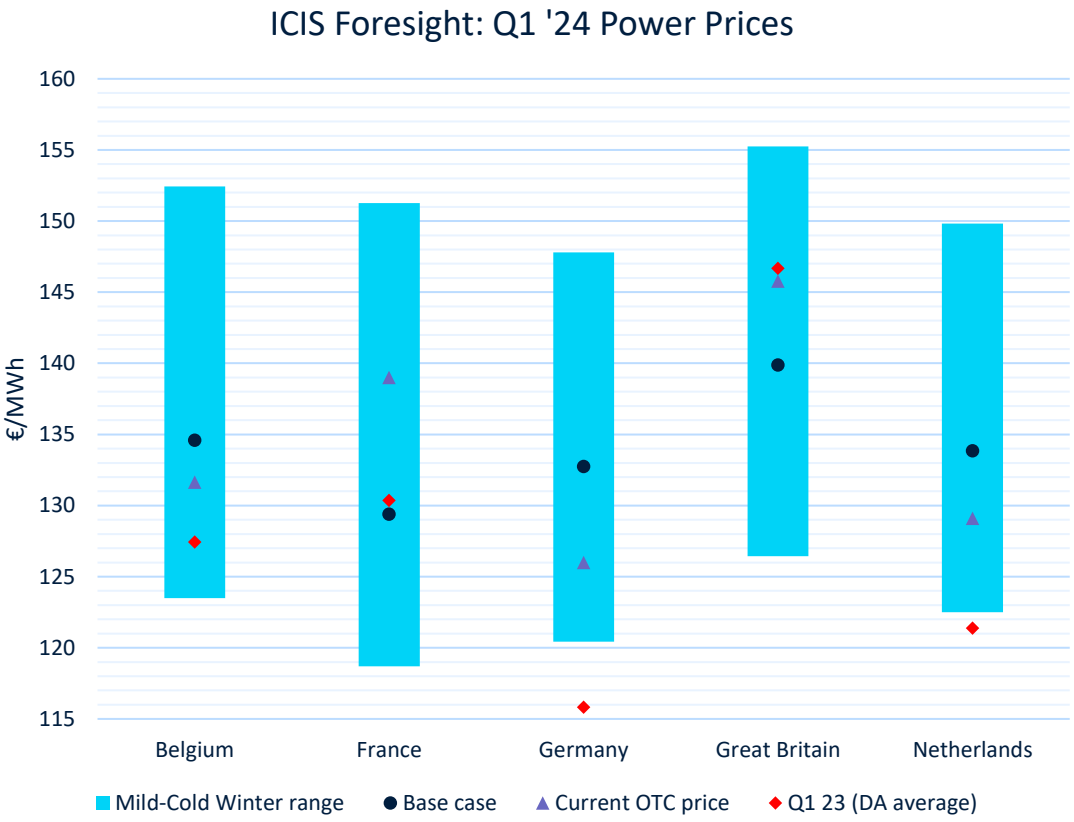
- The following chart shows the Winter 23/24 prices resulting from the three scenarios, for the countries under analysis.



- France is the most weather-sensitive market, with an overall swing of almost €33/MWh (around 26% of the base case price), while the price range for the other countries is limited to around €25/MWh (20% swing).
- Moreover, France is the only market whose price upside and downside are not symmetrical. Winter prices can increase up to 14% in the case of a cold winter and decrease by just 11% with mild weather.
    - While French and German prices are roughly in line both in the base case and mild winter scenarios, the France-to-Germany spread would increase up to around €7/MWh in the event of a cold winter, with a consequent impact on net flows.
- Interestingly, even in the cold winter scenario, the expected prices are on average around 15% lower than last year, for all countries.
    - Compared to Winter 22/23, France and Great Britain are the countries where prices are expected to fall the most, mainly due to improved French nuclear availability.
    - Germany, on the other hand, will experience a smaller price reduction, due to its nuclear phase-out, and because the market was less affected by high gas prices last year thanks to the large potential for switching to coal.

Q1 ’24 power prices

- This section focusses on Q1 ’24 contracts, discussing the prices resulting from the three winter scenarios and comparing them to the market prices.
    - Monthly contract prices are available to ICIS Power Foresight subscribers on the portal.



- Compared to the whole winter period, the picture is rather different as prices are expected to be higher than last year in most of the countries in Q1 '24, with gas prices being the main driver.
    - Indeed, gas prices dropped significantly in Q1 '23 compared to November and December '22 (around 50% reduction), while they are expected to stay roughly constant throughout this winter, with a slight contango.
- German Q1 '24 prices are projected to be higher than last year, even in the event of a mild winter, arguably due to the German nuclear phase-out that will make gas the price setter for more hours.
- In France, the current OTC price is almost in line with the cold winter scenario, thus highlighting the downside potential of the French Q1 '24 contract.
- Yet, France shows the largest price rise in the event of a cold winter, namely a 17% increase compared with an average of 12% in the other countries.
- By contrast, the downward variation in the mild winter scenarios is evenly around just 9% for all countries.
- As a result, based purely on weather conditions, Q1 '24 prices are skewed towards a higher risk of price increases than towards a reduction.

Market impact

- European gas demand for power generation is expected to range from 34bcm in the mild winter scenario up to 48bcm in the cold winter scenario, thus impacting around 6% of the gas balance in the winter period.
- European carbon emissions from the power sector could be affected up to a 20% swing, thus impacting around 10% of total ETS-scope emissions.
- Based on current fuel prices, power prices between November and March are expected to be on average lower than last year, even in the event of a cold winter.
- France and Great Britain are the countries where prices are expected to fall the most compared to last winter, mainly due to improved French nuclear availability, with Germany at the other end.
- Yet, France is the most weather-sensitive market, with an overall swing of almost €33/MWh, while the price range for the other countries is limited to around €25/MWh.